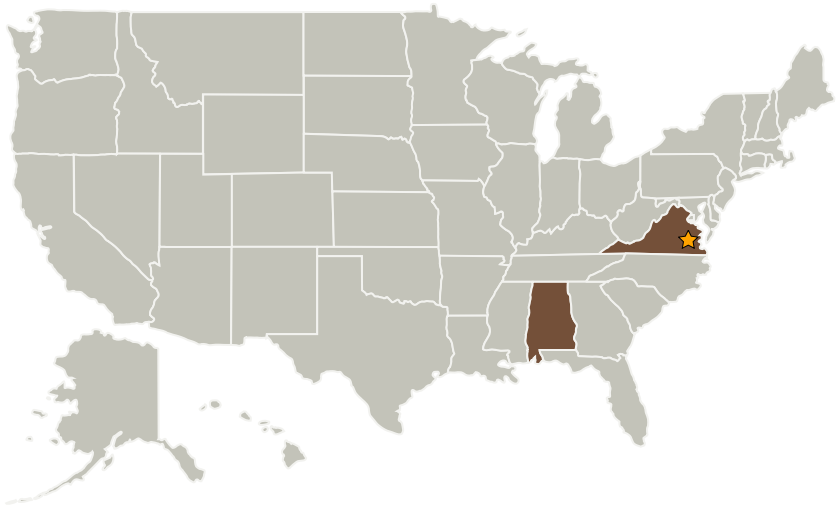
Computational Tool for Aerothermal Environment Around Transatmospheric Vehicles, Phase I

Completed Technology Project (2007 - 2007)

Project Introduction

The goal of this Project is to develop a high-fidelity computational tool for accurate prediction of aerothermal environment on transatmospheric vehicles. This computational tool will be based on the Unified Flow Solver (UFS) developed at CFDRC for hybrid simulations of rarefied, transitional and continuum flows. In this Project, the UFS will be enhanced with advanced non-equilibrium chemistry coupled to radiation transport and plasma capabilities. The enhanced UFS will include Boltzmann/continuum solvers for gas species and plasma electrons, state-to-state vibrational kinetics of molecules, advanced non-equilibrium chemistry coupled to radiation transport with real gas effects, and charged particle transport and chemistry. Our two strong points are (i) master equations coupled with nonequilibrium chemistry in a multidimensional code, and (ii) Boltzmann solvers for charges and neutral particles providing the capability of using the code both for reentry flows and for the low-temperature plasma flows. Phase I will be devoted to evaluation of physical models, initial implementation and demonstration of new capabilities. In Phase II, these capabilities will be fully developed, validated and demonstrated for selected benchmark problems. The availability of the proposed tool will bring the fidelity of modeling high speed flows of molecular gases to a next level and enable computational investigation of innovative concepts of plasma technologies for different applications.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
CFD Research Corporation	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Virginia

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.2 Aerothermodynamics